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Evaluating the AD9834 20 mW Power, 2.3 V to 5.5 V, 75 MHz Complete DDS

FEATURES

Full featured evaluation board for the AD9834 evaluation board
Graphic user interface software for board control and data analysis
Connector to the EVAL-SDP-CB1Z System Demonstration Platform (SDP) board
Various power supply and reference link options

APPLICATIONS

Biomedical sensors
Bioelectrical impedance analysis
Electrochemical analysis
Impedance spectroscopy
Complex impedance measurement
Nondestructive testing

GENERAL DESCRIPTION

The AD9834 is a 75 MHz, low power DDS device capable of producing high performance sine and triangular outputs. It also has an on-board comparator that allows a square wave to be produced for clock generation. Consuming only 20 mW of power at 3 V makes the AD9834 an ideal candidate for power-sensitive applications.

The EVAL-AD9834SDZ board is used in conjunction with a EVAL-SDP-CB1Z board available from Analog Devices, Inc. The USB-to-SPI communication to the AD9834 is completed using this Blackfin®-based development board.

A high performance, on-board 75 MHz trimmed general oscillator is available to use as the master clock for the AD9834 system. Various links and SMB connectors are also available on the EVAL-AD9834SDZ board to maximize the usability.

Complete specifications for the AD9834 are provided in the AD9834 data sheet, available from Analog Devices, and should be consulted in conjunction with this user guide when using the evaluation board.

FUNCTIONAL BLOCK DIAGRAM

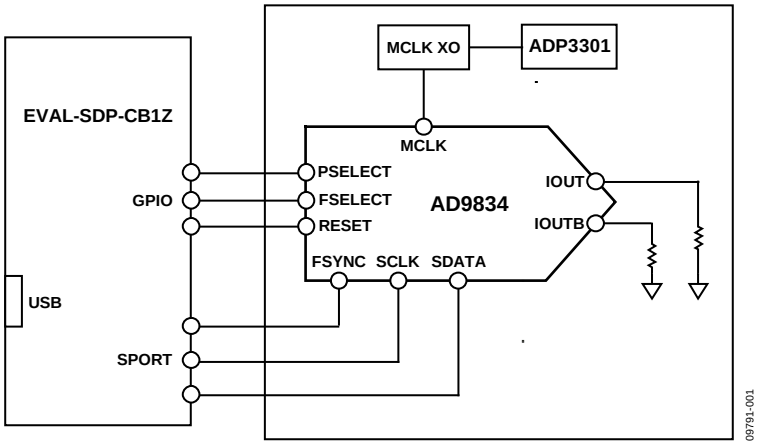

Figure 1.

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REVISION HISTORY

4/11—Revision 0: Initial Version

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The EVAL-AD9834SDZ evaluation kit includes the software and drivers on CD. The software is compatible with Windows® XP, Windows Vista, and Windows 7.

To install the software, follow these steps:

1. Install the software before connecting the SDP board to the USB port of the PC.
2. Start the Windows operating system and insert the EVAL-AD9834SDZ evaluation kit CD.
3. Download the AD9834SDZ LabVIEW™ software. The correct driver, SDPDriversNET, for the SDP board should download automatically after LabVIEW is downloaded, supporting both 32-bit and 64-bit systems. However, if the drivers do not download automatically, the driver executable file can also be found in the **Program Files/Analog Devices** folder. Follow the on-screen prompts to install the SDPDriverNet Version 1.3.6.0.
4. After installation of the software and drivers is complete, plug the EVAL-AD9834SDZ into the SDP board and the SDP board into the PC using the USB cable included in the box.
5. When the software detects the evaluation board, proceed through any dialog boxes that appear to finalize the installation (**Found New Hardware Wizard/Install the Software Automatically** and so on).

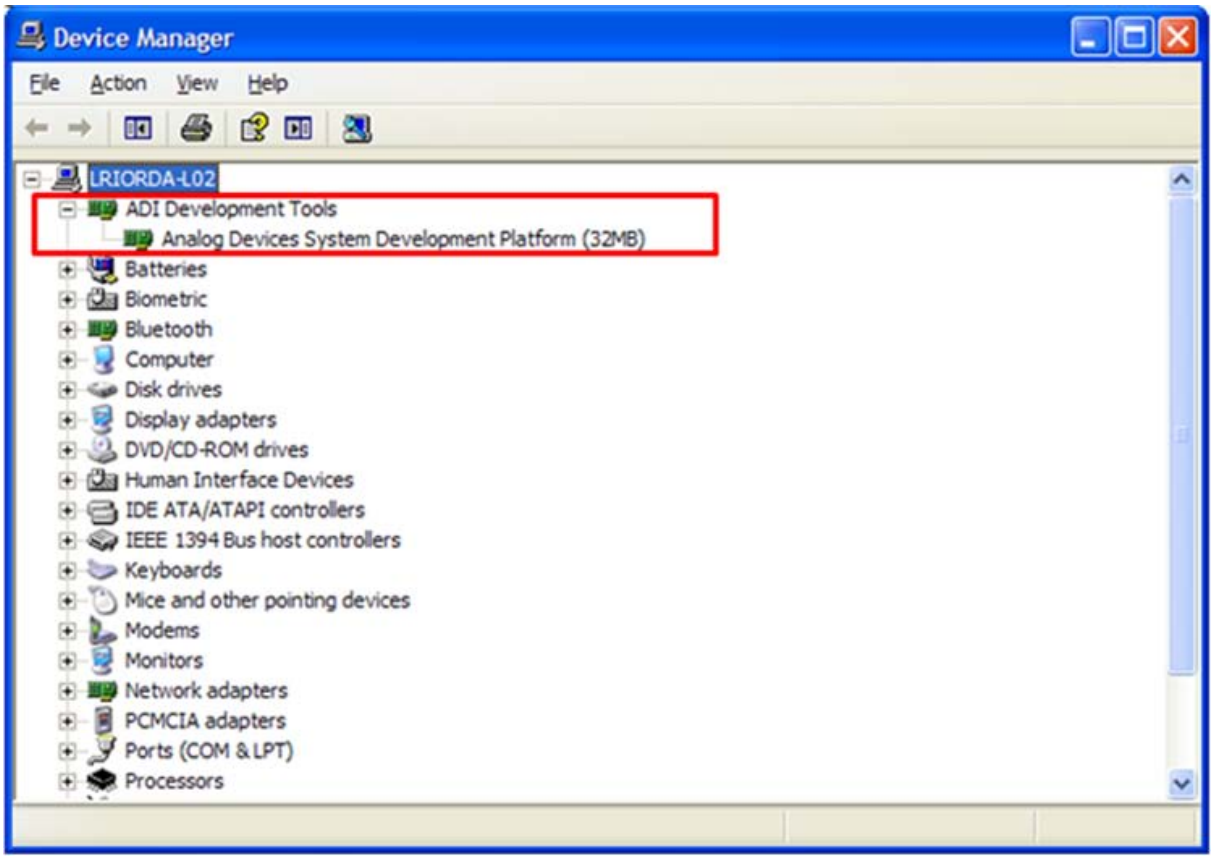

Figure 2. Hardware Device Manager Window with SDP Board Plugged In

RUNNING THE SOFTWARE

To run the evaluation board program, do the following:

1. Click **Start/All Programs/Analog Devices/AD9834/ AD9834 Eval Board**.
2. If the SDP board is not connected to the USB port when the software is launched, a connectivity error displays (see Figure 3). Simply connect the evaluation board to the USB port of the PC, wait a few seconds, click **Rescan**, and follow the instructions.
3. Ensure that all links are in their correct locations (see Table 1). The main window of the AD9834 evaluation software then opens, as shown in Figure 4.

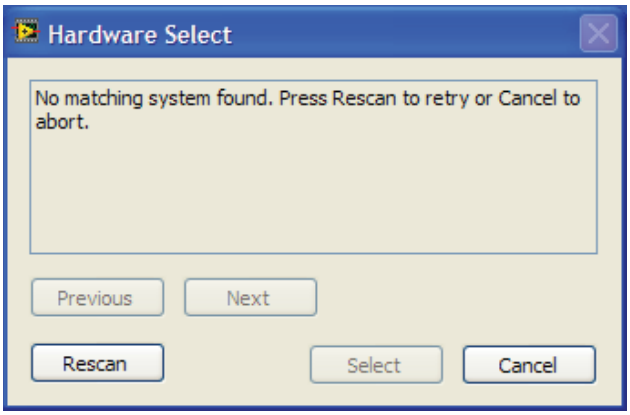

Figure 3. Pop-Up Window Error

Table 1. Default Setup for Link Positions

Link No.	Position	Function
LK1	A	On-board linear regulator selected to supply power to the general oscillator.
LK2	B	3.3 V digital supply for the AD9834 supplied from the EVAL-SDP-CB1Z board.
LK3	In	Decouple the CAP/2.5V pin to ground because V_{DD} is >2.7 V.
LK4	B	3.3 V analog supply for the AD9834 supplied from the EVAL-SDP-CB1Z board.

EVALUATION BOARD SOFTWARE

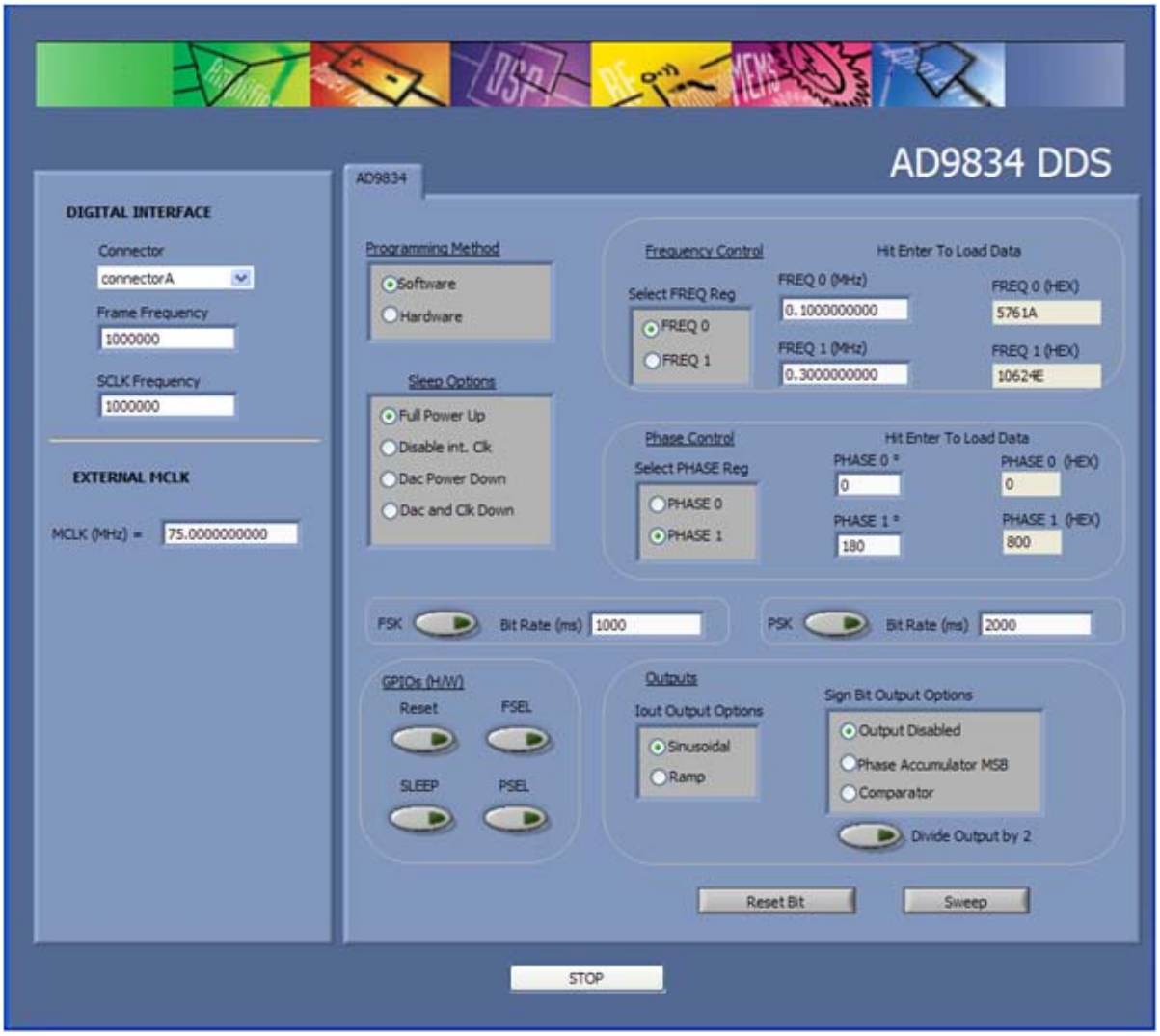

Figure 4. AD9834 Evaluation Board Software

SETTING UP THE DIGITAL INTERFACE

The first software step in setting up the AD9834 to make some measurements is to set the **DIGITAL INTERFACE**. The EVAL-SDP-CB1Z has two connector plugs: **connectorA** and **connectorB**. Select which connector you want to use with the AD9834 evaluation board from the drop-down menu.

The SPI **Frame Frequency** (/SYNC) box and **SCLK Frequency** box can also be set in this window. If the SPI interface speed has not been decided upon, leave the default values shown in Figure 5.

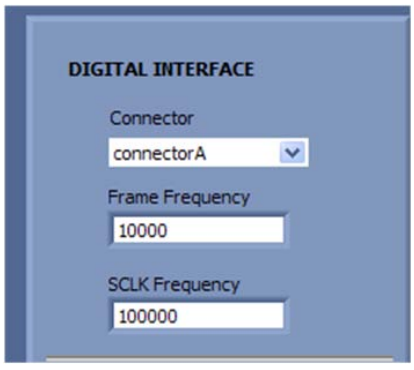

Figure 5. Digital Interface

SELECT EXTERNAL MCLK FREQUENCY

Having selected the digital interface specifics, next use the **EXTERNAL MCLK** box to choose which frequency to use. The boards are supplied with a 75 MHz general oscillator. If a different clock source is required, the CLK1 SMB connector can be used to supply a different MCLK value.

Two options for the general oscillator include the AEL3013 oscillators from AEL Crystals and the SG-310SCN oscillators from Epson Electronics.

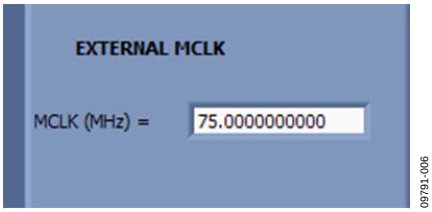

Figure 6. EXTERNAL MCLK Input

PROGRAMMING METHOD: HARDWARE OR SOFTWARE

Functions that select frequency and phase registers, reset internal registers, and power down the DAC can be implemented using either software or hardware. Figure 7 shows how to select the source of control for these functions. PIN/SW = 1 implies that the functions are being controlled using the appropriate hardware control pins. PIN/SW = 0 implies that the functions are being controlled using the appropriate software control bits.

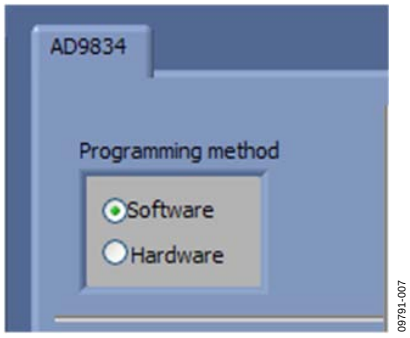

Figure 7. Programming method

LOADING FREQUENCY AND PHASE REGISTERS

The desired output frequency and output phase can be loaded using the inputs shown in Figure 8. Either the FREQ 0 register or the FREQ 1 register can be loaded with frequency data. The frequency data is loaded in megahertz, and the equivalent hex code is shown to the right once data is entered; click **Enter** to load the data. Once data is loaded, the output will appear on the IOUT and IOUTB pins. Similarly, either the PHASE 0 register or the PHASE 1 register can be selected, and the phase data is loaded in degrees.

The analog output frequency from the AD9834 is defined by

$$f_{MCLK}/2^{28} \times FREQREG$$

where *FREQREG* is the value loaded into the selected frequency register in decimals. This signal is phase shifted by

$$2\pi/4096 \times PHASEREG$$

where *PHASEREG* is the value contained in the selected phase register in decimals.

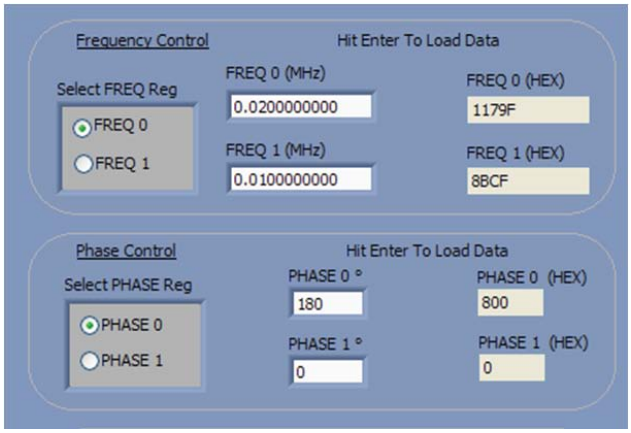

Figure 8. Frequency and Phase Load

FSK AND PSK FUNCTIONALITY

In software mode, the AD9834 can be setup for FSK or PSK functionality by simply entering the bit rate in milliseconds and selecting the push-button option (see Figure 9).

Figure 9. FSK and PSK Functionality

WAVEFORM OPTIONS

The output waveform can be selected as a sinusoidal waveform or a ramp waveform. The internal comparator in the AD9834 can be disabled or enabled (see Figure 10). The MSB or the MSB/2 of the phase accumulator can be selected as the output on the SIGN BIT OUT pin.

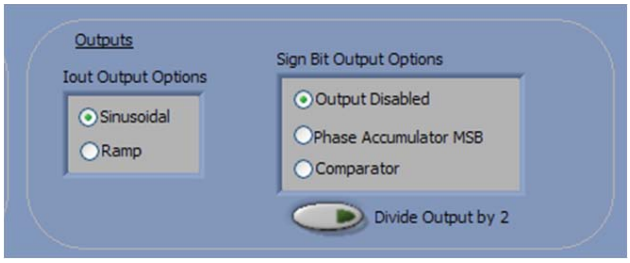

Figure 10. Waveform Profile and SIGN BIT OUT

POWER-DOWN OPTIONS

The AD9834 has various power-down options selected through the control register. The part can disable the MCLK or disable the DAC if just the MSB output is used on the SIGN BIT OUT pin, or it can power down both sections for a lower power sleep mode (see Figure 11).

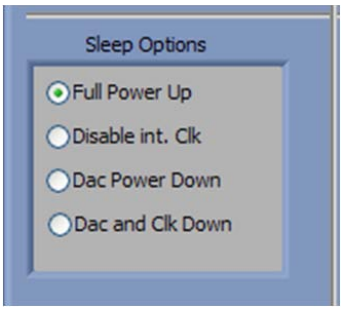

Figure 11. Power-Down Options

HARDWARE OPTIONS

If the hardware programming method is selected as described in Figure 7, the following pin functions can be toggled, FSELECT, PSELECT, RESET, and SLEEP. These are controlled by the GPIO outputs on the EVAL-SDP-CB1Z board. For example, frequency data can be loaded to the FREQ 0 register and the FREQ 1 register, and the output can be toggled by the FSELECT pin, that is, 2FSK functionality.

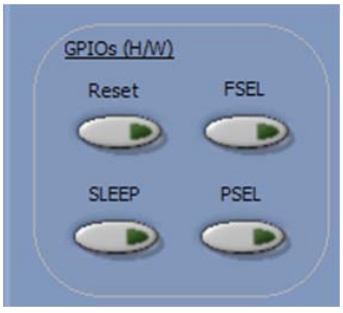

Figure 12. GPIO Hardware Pin Control

RESET AND SWEEP

The reset software command is set using the push-button shown in Figure 13. To setup a DDS sweep, click **Sweep**.

Figure 13. Software Reset and Sweep Select

The sweep function allows users to load a start frequency, stop frequency, increment size, number of loops, and delay between each frequency increment. These commands are then loaded to the part automatically from the EVAL-SDP-CB1Z board.

Figure 14. Sweep Functionality

EXAMPLE OF OPERATION

An example of configuring the AD9834 to output 1 MHz follows:

1. Plug the EVAL-SDP-CB1Z board into the EVAL-AD9834SDZ board and connect to the USB port.
2. Start up the software located at **Start/All Programs/Analog Devices/AD9834/AD9834 Eval Board**. Users should see the SDP board communicating with the PC.
3. Select **connectorA** or **connectorB**; this must match what the AD9834 test chip is connected to.
4. Define MCLK; the default is an on-board 75 MHz oscillator.
5. Ensure that all links are in the correct locations (see Table 1).
6. Select the FREQ 1 register.
7. Load a 1 MHz excitation frequency and click **Enter**.

The output should appear on the IOUT and IOUTB outputs on the evaluation board.

For the FREQ 0 register,

- Select the FREQ 0 register.
- Load the FREQ 0 register with 2 MHz and click **Enter**.

For the FREQ 1 register,

- Select the FREQ 1 register to load the 1 MHz associated with this register.

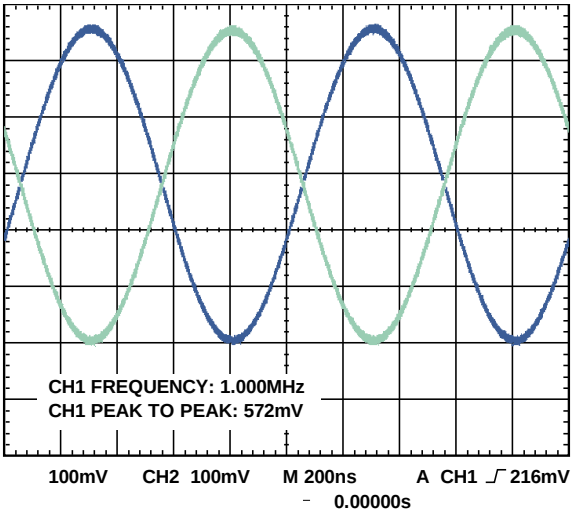

Figure 15. 1 MHz Output Signals on the IOUT and IOUTB Test Points

EVALUATION BOARD SCHEMATICS AND LAYOUT

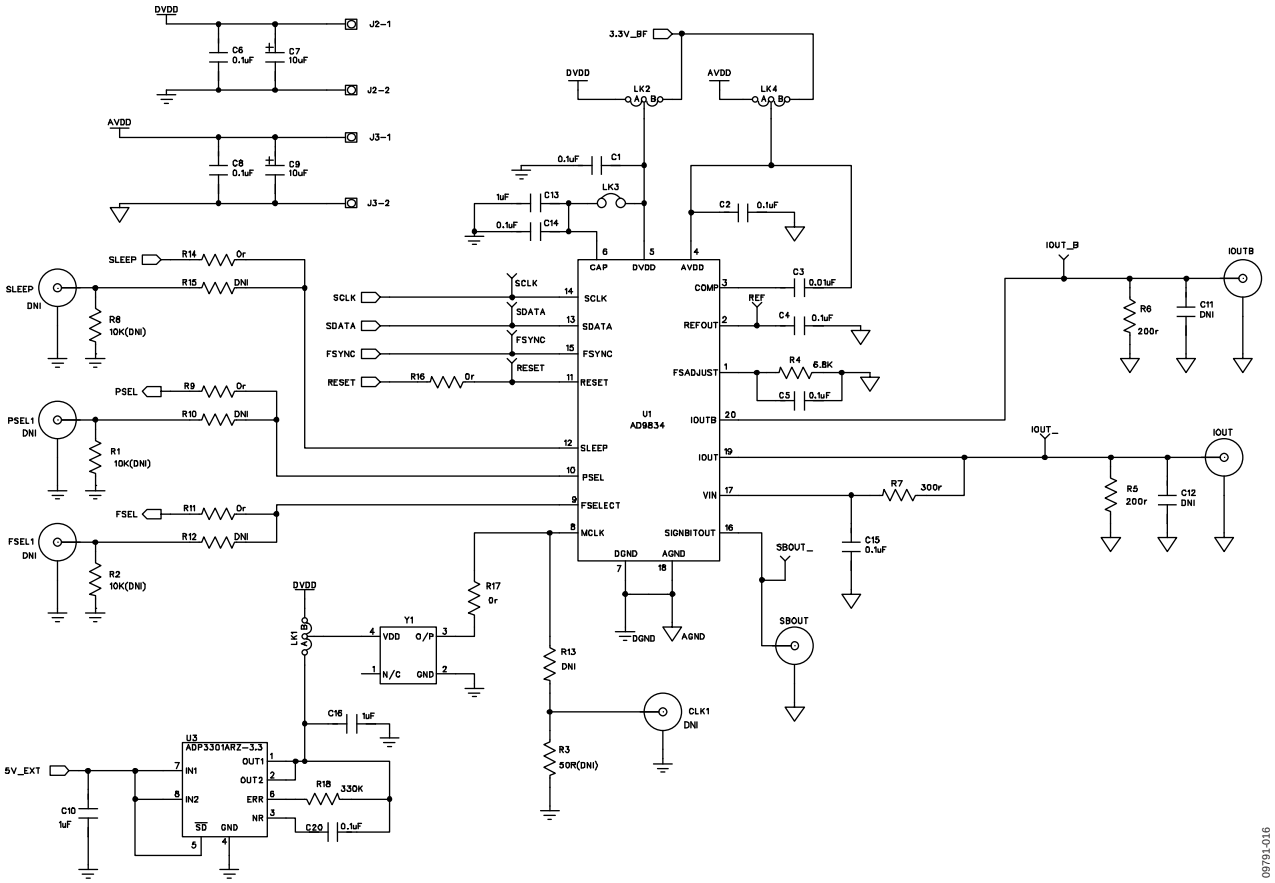

Figure 16. AD9834 Schematic Part A

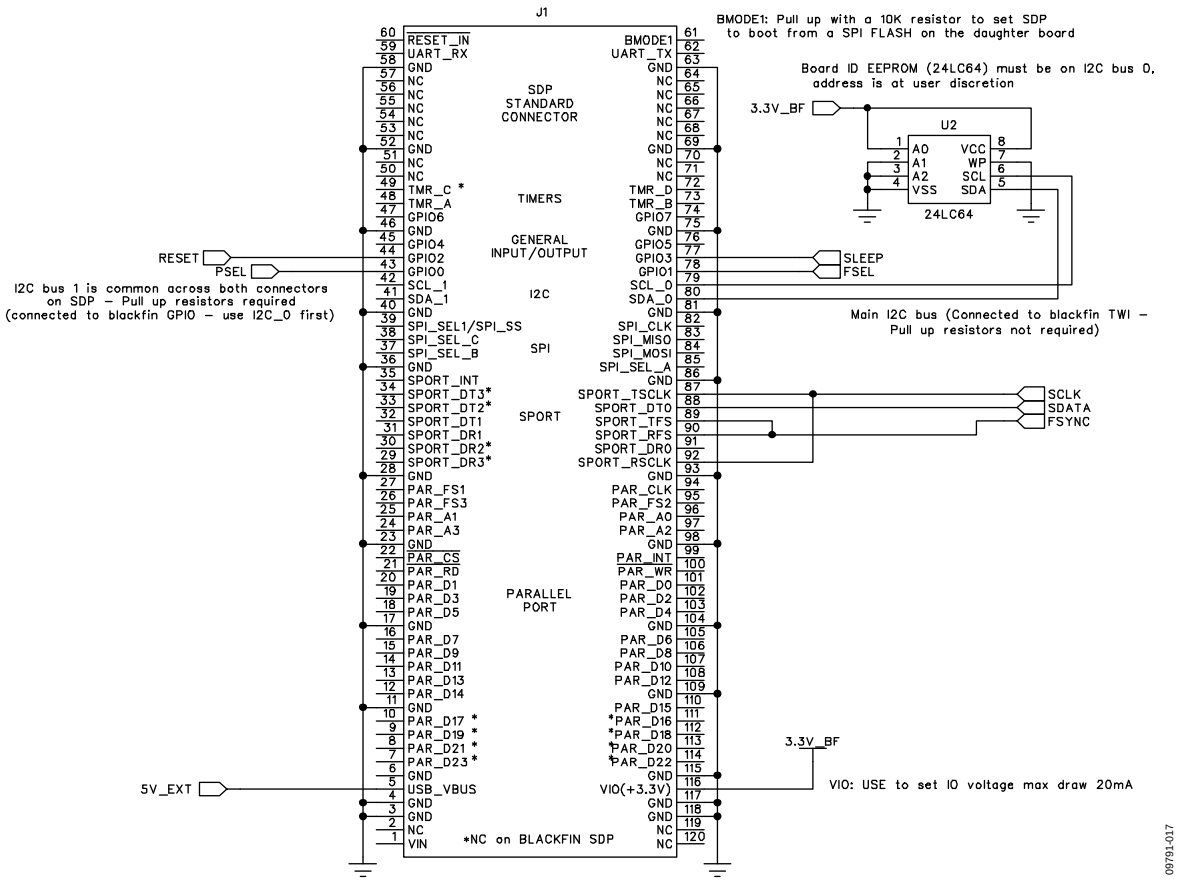
J1
BMODE1: Pull up with a 10K resistor to set SDP to boot from a SPI FLASH on the daughter board
Board ID EEPROM (24LC64) must be on I2C bus 0, address is at user discretion
3.3V_BF
U2
24LC64
SDP STANDARD CONNECTOR
TIMERS
GENERAL INPUT/OUTPUT
I2C
SPI
SPORT
PARALLEL PORT
RESET
PSEL
SLEEP
FSEL
I2C bus 1 is common across both connectors on SDP – Pull up resistors required (connected to blackfin GPIO – use I2C_0 first)
Main I2C bus (Connected to blackfin TWI – Pull up resistors not required)
SCLK
SDATA
FSYNC
5V_EXT
VIO: USE to set IO voltage max draw 20mA
*NC on BLACKFIN SDP
09791-017

Figure 17. AD9834 Schematic Part B

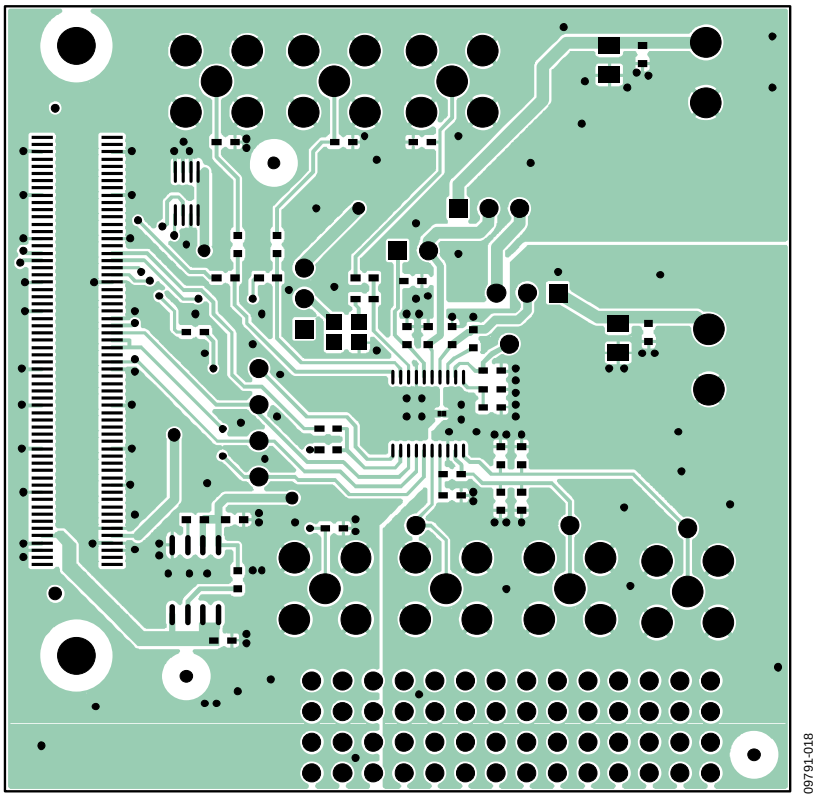

Figure 18. Component Side View Layer 1

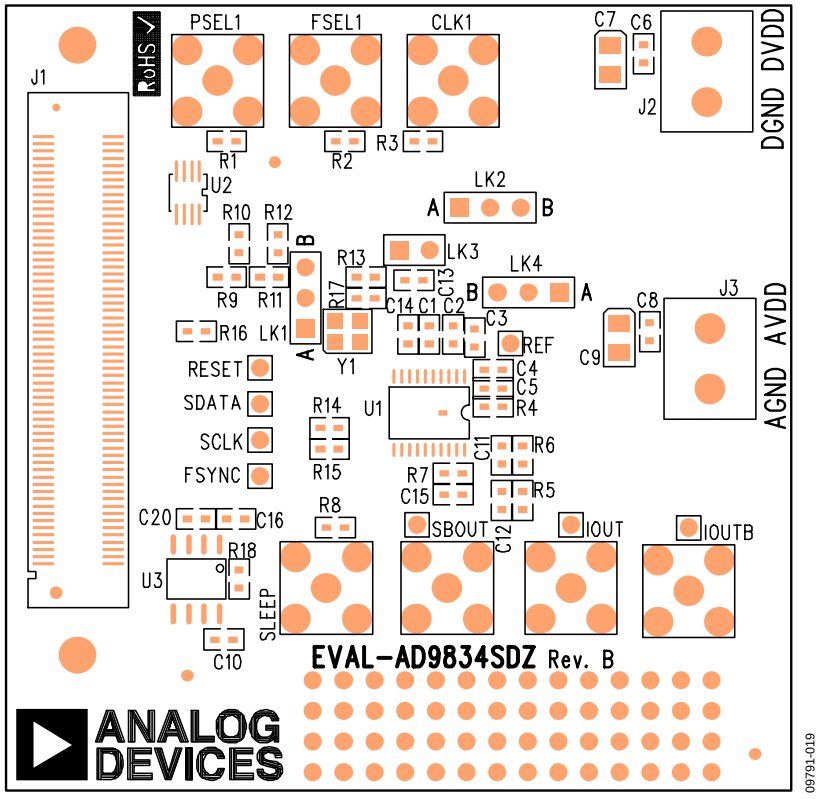

Figure 19. Component Side View Silkscreen

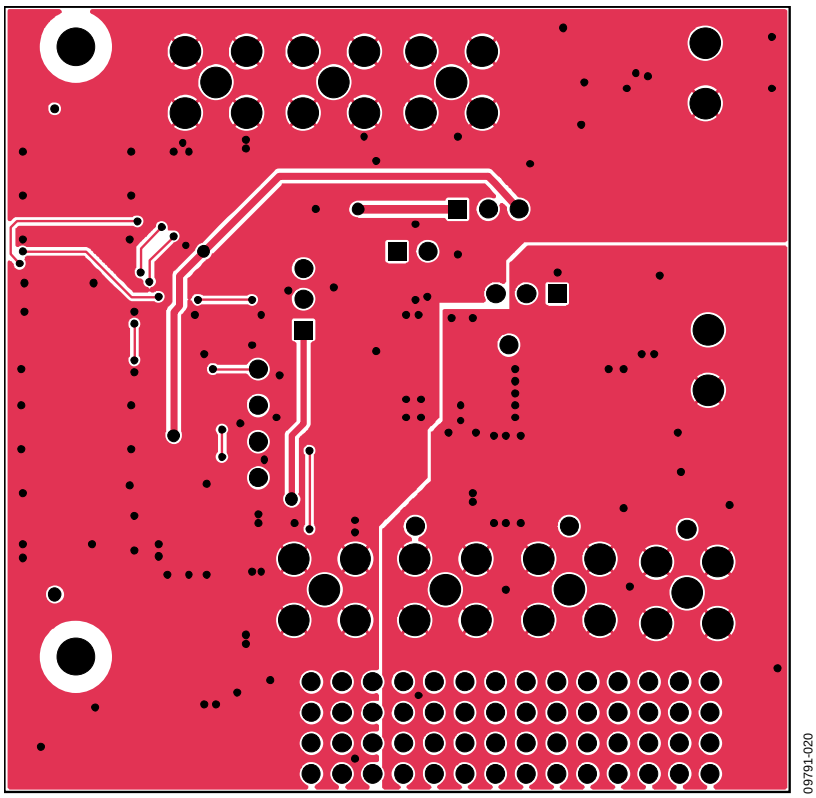

Figure 20. Component Side View Layer 2, Solder Side

ORDERING INFORMATION

BILL OF MATERIALS

Table 2.

Reference Designator	Description	Manufacturer	Part Number
C1, C2, C4, C5, C6, C8, C11, C12, C14, C15	0.1 µF, ±10%, 50 V, X7R, ceramic capacitor	Murata	GRM188R71H104KA93D
C3	0.01 µF, ±10%, 10 V, 0603, X5R, capacitor	Kemet	C0603C103K5RACTU
C7, C9	10 µF, ±10%,10 V, SMD tantalum capacitor	AVX	TAJA106K010R
C10, C13, C16	1 µF, ±10%,10 V,Y5V, 0603, ceramic capacitor	Yageo	CC0603ZRY5V6BB105
C20	0.1 µF, ±10%, 16 V, X7R, 0603, capacitor	Multicomp	B0603R104KCT
CLK1[1], FSEL1[1], IOUT, IOUTB, PSEL1[1], SBOUT, SLEEP	Straight PCB mount SMB jack, 50 Ω	Tyco	1-1337482-0
FSYNC, IOUT_, IOUT_B, REF, RESET, SBOUT_, SCLK, SDATA	Red test point	Vero	20-313137
G1	Copper short	Not applicable	Not applicable
J1	120-way connector, 0.6 mm pitch receptacle	HRS (Hirose)	FX8-120S-SV(21)
J2, J3	2-pin terminal block (5 mm pitch)	Campden	CTB5000/2
LK1, LK2, LK4	3-pin SIL header and shorting link	Harwin	M20-9990345 and M7567-05
LK3	2-pin SIL header and shorting link	Harwin	M20-9990246
R1[1], R2[1], R8[1]	10 kΩ, ±1%, 0603, SMD resistor	Multicomp	MC 0.063W 0603 10K
R3[1]	50 Ω, ±1%, 0603, SMD resistor	Multicomp	MC 0.063W 0603 50r
R4	6.8 kΩ, ±1%, SMD resistor	Multicomp	MC 0.063W 0603 6K8
R5, R6	200 Ω, ±1%, SMD resistor	Multicomp	MC 0.063W 0603 200r
R7	300 Ω, ±1%, SMD resistor	Multicomp	MC 0.063W 0603 300r
R9, R10[1], R11, R12[1], R13[1], R14, R15[1], R16, R17	0 Ω, ±1%, 0603, SMD resistor	Multicomp	MC 0.063W 0603 0r
R18	330 kΩ, ±5%, SMD resistor	Multicomp	MC 0.063W 0603 330KR
U1	20 mW power, 2.3 V to 5.5 V, 75 MHz complete DDS	Analog Devices	AD9834BRUZ
U2	64K I^2C serial EEPROM 8-lead MSOP	Micro Chip	24LC64-I/MS
U3	High accuracy anyCAP® 100 mA low dropout linear regulator	Analog Devices	ADP3301ARZ-3.3
Y1	75 MHz, 3 mm × 2 mm SMD clock oscillator	AEL Crystals	AEL301
Or Y1	75 MHz, 3 mm × 2 mm SMD clock oscillator	Espson Electronics	SG-310SCN

[1] Do not install.

NOTES

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NOTES

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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UG09791-0-4/11(0)

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